
Executive Summary

Introduction

The Lynchburg Fire & EMS Department (LF&EMS) has operated under stated general response time goals for many years. However, it had not developed and adopted clearly defined standards of response coverage (SORC). The Department is currently in the self-assessment phase of the accreditation process of the Commission on Fire Accreditation International (CFAI). One requirement of a fire agency to receive accreditation is to prepare a SORC plan before or during the self-assessment phase of accreditation. SORC is defined as those written procedures determining the distribution and concentration of fixed and mobile resources. This process includes reviewing community expectations, setting response goals and objectives and establishing a system of measuring performance. This document will serve as a critical element of the accreditation process.

This process uses a systems approach to deployment rather than a one-size-fits-all prescriptive formula. In this comprehensive approach, LF&EMS is matching local need (risks and expectations) with the costs of various levels of service. In an informed public policy debate, City Council “purchases” the fire and EMS protection (insurance) the community needs and can afford.

LF&EMS will utilize this analysis to more comprehensively address a number of issues. This SORC plan will provide:

- A baseline tool for defining emergency response performance standards and goals;
- A summary of community risk (life safety, economic and environmental);
- An analysis of critical emergency scene tasks, which should assume maximum utilization of all personnel under a “worst case” scenario [This analysis should be consistent with the department’s risk analysis, staffing levels and goals];
- A basis for continually measuring performance over time; and
- Guidelines for short-term and long-term policy decisions dealing with resource procurement and allocation.

The SORC is developed through the systematic evaluation of the department's present policies, practices and historical response data. The results of these analyses are then used to develop formal statements regarding the level of service the department can be expected to provide, along with recommendations to make changes in the way services are delivered for the purpose of improving the level of service to the community.

Standards, Goals and Objectives

Historically, LF&EMS has not used a Standard of Response Cover document or statement to guide its operations. Instead, it has operated under a variety of documents, including a 5-year strategic plan, general orders, operational guidelines, policies and procedures, emergency medical services protocols and official memorandums from senior and operations level command staff. These documents provide guidance for operational and administrative functions, and are updated on both a scheduled and unscheduled basis.

LF&EMS conducted a significant revision to its long-term comprehensive planning efforts during the 2001 fiscal year. It was then that the department adopted its five-year strategic plan. The strategic plan is further implemented through annual business plans from its "focus area" and "strategic business" units.

The department linked its strategic plan with the adopted vision of City Council and citizen expectations. This was accomplished by surveying citizens, customer groups and City Council as well as analyzing council's "Lynchburg 2020 Vision Statement." The department's strategic plan was based on alignment with council's desired outcome to be "*A Community Environment Second to None.*"

Risk Assessment

The level of service provided by a fire & EMS department should be based on the agency's ability to cope with the various types and sizes of emergencies that they can reasonably expect after conducting a risk assessment. Overall community risk management consists of risk assessment and risk control. First, the department needs to identify the magnitude and scope of the risk of fire, rescue, and medical emergencies, or other hazards that threaten life, safety, property, or the environment. This analysis is based upon both actual and potential losses.

Developing a risk assessment traditionally involves an analysis of six key components. These apply to fire, rescue, medical and miscellaneous calls for service. The six components include:

- **Fire Flow** (water) [fire emergencies only]– the amount of water required to both control and extinguish a fire emergency, based on the contents, square footage, construction type, and the use of combustible materials.
- **Probability** – the likelihood that a particular event will occur within a given period of time. An event that occurs daily is highly probable. An event that occurs only once in a century is very unlikely. Probability is an estimate of how often an event will occur, based on local historical data.
- **Consequence** – two primary components: life safety (risk to the lives of occupants and responders from life-threatening situations that include fire, rescue, hazardous substance and emergency medical events) and economic impact (the loss of property, income or irreplaceable assets).
- **Occupancy risk** – an assessment of the relative risk to life and property resulting from a fire inherent in a specific occupancy or in generic occupancy classes.
- **Demand zones** – geographic area utilized to analyze risk situations. Lynchburg uses “response zones” as its primary type of demand zone for analysis purposes. Response zones are based on current fire station locations and correspond to the first-due response area for each of the stations. Current fire station placement and resource assignment has been determined by response time performance, transportation network, population, topography, construction and occupancy character, density, and the relative risk level of a particular neighborhood or area.
- **Community Profile** – an analysis of the attributes of the community based on the unique mixture of demographics, socioeconomic factors, occupancy risk, demand zones, historical trends and level of service currently being provided.

Critical Task Capability

Emergency events occur at all hours, all days, and under all conditions. Emergencies are like lightning strikes – they occur anytime, anywhere. The fire service’s response to these unpredictable conditions has been to develop a methodology for being prepared to respond in a timely fashion when they occur. The operative word is *timely*.

The ability of a fire & EMS department to comprise an effective response force when confronted with the need to perform required tasks on a fire or EMS incident scene is its ability to provide adequate resources to mitigate each event. LF&EMS believes that time, which equates to speed and positive performance in performing fire ground tasks, is the benchmark for a response force to be successful. To meet the challenges of time and on-scene expectations, benchmarks of operational preparedness guide LF&EMS.

The rapid and effective performance of highly coordinated assigned tasks is the hallmark of a successful emergency response force. Time and on-scene performance expectations are the target indicators established for measuring the operational elements (individuals, crews, and work units) that comprise LF&EMS response-ready resources.

NFPA 1710

National Fire Protection Association (NFPA) ¹ 1710 is the Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments. This standard outlines an organized approach to defining levels of service, deployment capabilities, and staffing for “substantially” career fire departments. Specifically NFPA 1710 provides standard definitions for fire apparatus, personnel assigned, procedural guidelines within which they operate, and staffing levels needed to accomplish specific tasks on arrival at an incident.

NFPA 1710 states that fire departments shall establish a performance objective of not less than 90 percent for each of the following response time objectives:

- One minute (60 seconds) for turnout time².
- Four minutes (240 seconds) or less for the arrival of the first-arriving engine company at a fire suppression incident and/or eight minutes (480 seconds) or less for the arrival of a full alarm assignment at a fire suppression incident (including one individual for incident command outside of the hazard area).

¹ The National Fire Protection Association develops and publishes fire and life safety consensus standards, some of which address fire department organization, procedures, and activities.

² Turnout Time is the interval between the activation of station and/or company alerting devices (plus the delivery of specific dispatch information to emergency personnel), and the time when the responding crew(s) notifies the dispatch center that the company is en route.

- Four minutes (240 seconds) or less for the arrival of a unit with first responder, or higher level of capability at an emergency medical incident.
- Eight minutes (480 seconds) or less for the arrival of an advanced life support unit at an emergency medical incident, where this service is provided by the fire department.

NFPA 1710 outlines staffing, deployment, and response time standards for career fire departments. While LF&EMS has not adopted the response times in NFPA 1710 as a local standard, it will regularly measure its response time performance against those times. LF&EMS also utilizes standards established by the American Heart Association (AHA) as related to emergency medical incidents.

Service Level Objectives

The key terms in understanding standards of response coverage are: *distribution, concentration, overall resource efficiency, response reliability and response effectiveness*. They are quantifiable performance measures that can be used by the fire department to objectively and quantitatively analyze the relationship between existing or new fire station locations and the department's capability.

The location of fire stations impacts only one segment of the continuum, travel time from the fire station. *Travel time* and *response time* are not the same thing. When we say that a particular station has a four-minute *travel time* to an address, it doesn't mean that a unit will arrive there in four minutes from the caller's viewpoint. Nor will the unit always respond from a fire station.

Minimum staffing and equipment needs have been established for each level of risk, LF&EMS has determined how fast the entire force of staffing and equipment must reach the fire scene to be effective. Data from literature regarding fire growth and the department's own historical incidents have been used to determine the maximum travel time that would allow the staffing and equipment to get to a fire scene while a fire was still in its early stages of growth and to get to a medical scene before significant deterioration of the patient's condition occurs.

The term "distribution" describes the resource locations needed to minimize and terminate emergencies by assuring a sufficiently rapid first due response deployment. Distribution is measured by the percentage of the jurisdiction

covered by first-due, or primary, response companies within the adopted public policy response time goals for each risk type and outcome measure.

The measure of distribution is based on risk. Therefore it is possible for some low-risk response zones to have adequate distribution of coverage because they can handle longer travel times, while high-risk zones have shorter travel times and might not get a first-due company on scene quickly enough to meet identified goals for that risk.

This concept is reflected in the distribution of fire companies to assure a specific response time performance goal for a certain fractile of the calls for service. In a perfect world, 100 percent of the community would have a fire company on scene within the response travel time goal. In the real world the distribution of fire companies is very good if the fire companies can arrive at least 90 percent of the time within the stated time goal.

This view of Lynchburg's response system looks at fire & EMS resource deployment in terms of a static placement of resources and their theoretical response potential. By taking this theoretical view of the system it is possible to determine whether or not response standards can be met from existing infrastructure and with current staffing levels, when all companies and units are in quarters and available for emergency response.

Integrated Time and Performance Standards

Now that all risk, time and critical task issues have been identified and measured, the following integrated performance goal statements have been established. These will be used to model deployment for both distribution and concentration in the later steps of this standard of response cover process.

Structure Fire, Low Risk

Goal: An effective response force of three to four personnel deployed via one engine company.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for emergency service.

Performance Objective: To stop the escalation of a minor fire where found. Typically this means conducting search and rescue for any victims, confining the fire damage near the room of origin, plus limiting heat and smoke damage to near the room of fire origin. The first arriving unit is capable of starting rescue work or advancing a first line for the fire control. A second engine and/or truck company may be called to provide additional personnel for tasks already started plus, ventilation, salvage, and other work as necessary.

Structure Fire, Moderate Risk

Goal: An effective response force of seventeen personnel deployed via three engine companies, one truck company, one rescue company, one medic unit, and one battalion chief shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for emergency service. Remaining units, including the battalion chief, shall arrive in 10 minutes total reflex time, for 90 percent of all requests for emergency services.

Performance Objective: To stop the escalation of a moderate fire where found. Typically this means conducting search and rescue for any victims, confining the fire damage to the room of origin, plus limiting heat and smoke damage to near the room of fire origin. The first arriving unit is capable of starting rescue work or advancing a first line for fire control. The second engine and truck company provide additional personnel for tasks already started plus ventilation, salvage, and other work as necessary.

Structure Fire, Significant Risk

Goal: An effective response force of twenty-three personnel deployed via four engine companies, two truck companies, one rescue company, one medic unit, and two battalion chiefs shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for emergency service. The second-due engine and first-due truck company shall arrive within 10 minutes total reflex time, for 90 percent of all requests for emergency service. Remaining

units, including the battalion chiefs, shall arrive in 14 minutes total reflex time, for 90 percent of all requests for emergency services.

Performance Objective: To stop the escalation of a serious fire where found. Typically this means conducting search and rescue for any victims, confining the fire damage near the room of origin, plus limiting heat and smoke damage to the area or floor of fire origin. The tasks of rapid intervention rescue for trapped firefighters, property salvage, and crew rotation with rehabilitation at a minimum of eleven additional personnel are required on a fire in this risk category.

Structure Fire, Maximum Risk

Goal: An effective response force of thirty to thirty-four personnel deployed via five engine companies, two truck companies, one rescue company, two medic units, and two battalion chiefs shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for emergency service. The second-due engine and first-due truck company shall arrive within 10 minutes total reflex time, for 90 percent of all requests for emergency service. Remaining units, including the battalion chiefs, shall arrive in 16 minutes total reflex time, for 90 percent of all requests for emergency services.

Performance Objective: To stop the escalation of a maximum fire where found. Typically this means conducting search and rescue for any victims, confining the fire damage near the room of origin, plus limiting heat and smoke damage to the area or floor of fire origin. The tasks of rapid intervention rescue for trapped firefighters, property salvage, and crew rotation with rehabilitation at a minimum of thirteen additional personnel are required on a fire in this risk category.

Automobile Fires

Goal: An effective response force of three personnel deployed via one engine company shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of requests for automobile fire responses.

Performance Objective: To stop the escalation of a vehicle fire where found. Typically this means conducting search and rescue for any victims, confining the fire damage to the vehicle of origin, plus limiting heat and smoke damage to other exposures near the vehicle of fire origin. The first arriving unit is capable of starting rescue work or advancing a first line for the fire control. Additional engine and truck companies may be summoned to provide additional personnel for tasks already started plus, ventilation, salvage, and other work as necessary.

Brush Fires

Goal: An effective response force of three personnel deployed via one engine company shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for brush fires.

Performance Objective: To stop the escalation of a brush fire where found. Typically this means conducting search and rescue for any victims, confining the fire damage to the vehicle of origin, plus limiting heat and smoke damage to other exposures near the area of fire origin. The first arriving unit is capable of starting rescue work or advancing a first line for the fire control. Additional engine and truck companies may be summoned to provide additional personnel for tasks already started plus, ventilation, salvage, and other work as necessary. Specialized brush fire apparatus may be dispatched as well.

Trash/Dumpster Fires

Goal: An effective response force of three personnel deployed via one engine company shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for trash/dumpster fires.

Performance Objective: To stop the escalation of a trash/dumpster fire where found. Typically this means conducting search and rescue for any victims, confining the fire damage to the trash container/area of origin,

plus limiting heat and smoke damage to other exposures near the trash can/dumpster of fire origin. The first arriving unit is capable of starting rescue work or advancing a first line for the fire control. Additional engine and truck companies may be summoned to provide additional personnel for tasks already started plus ventilation, salvage, and other work as necessary.

Explosions

Goal: An effective response force of seventeen personnel deployed via three engine companies, one truck company, one rescue company, one medic unit, and one battalion chief shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for emergency service. Remaining units, including the battalion chief, shall arrive in 10 minutes total reflex time, for 90 percent of all requests for emergency services.

Performance Objective: To stop the escalation of a fire as a result of the explosion where found. Typically this means conducting search and rescue for any victims, confining the fire damage to the room of origin, plus limiting heat and smoke damage to near the room of fire origin. The first arriving unit is capable of starting rescue work or advancing a first line for fire control. The second engine and truck company provide additional personnel for tasks already started plus ventilation, salvage, and other work as necessary.

Transportation Emergencies/Fires

Goal: An effective response force of nine personnel deployed via one engine company, one truck company and the rescue company shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of requests for transportation fire responses.

Performance Objective: To stop the escalation of a transportation fire/emergency where found. Typically this means conducting search and rescue for any victims, confining the fire damage to the vehicle of origin,

plus limiting heat and smoke damage to other exposures near the vehicle of fire origin. The first arriving unit is capable of starting rescue work or advancing a first line for the fire control. Additional engine and truck companies may be summoned to provide additional personnel for tasks already started plus, ventilation, salvage, and other work as necessary.

Fire Alarms, Residential

Goal: An effective response force of three personnel deployed via one engine company shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for all residential fire alarms.

Performance Objective: To investigate the possible presence of potentially hazardous conditions that caused the activation of a residential alarm system. If such conditions are present, the first arriving unit is capable of starting rescue work or advancing a first line for the fire control. Additional engine and truck companies may be summoned to provide additional personnel for tasks already started plus, ventilation, salvage, and other work as necessary.

Fire Alarms, Commercial

Goal: An effective response force of six personnel deployed via one engine company and one truck company shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all commercial fire alarm activations. The full complement of responding apparatus shall arrive within 10 minutes total reflex time for 90% of all responses.

Performance Objective: To investigate the possible presence of potentially hazardous conditions that caused the activation of a commercial alarm system. If such conditions are present, the first arriving unit is capable of starting rescue work or advancing a first line for the fire control. Additional engine and truck companies may be summoned to provide additional personnel for tasks already started plus, ventilation, salvage, and other work as necessary.

Hazardous Materials Emergencies – Level I

Goal: An effective response force of three personnel deployed via one engine company shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all requests for hazardous materials – level I incidents.

Performance Objective: To stop spills, leaks, releases, ruptures, and/or fires involving hazmats which can be contained, extinguished, and/or abated utilizing equipment, supplies, and other resources immediately available to the first responders (Operations Level) of the LF&EMS.

Hazardous Materials Emergencies – Level II

Goal: An effective response force of twelve personnel deployed via one engine company, one rescue company, one medic unit, one battalion chief and the hazardous materials unit shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all for hazardous materials – level II incidents. The full complement shall arrive within twelve minutes total reflex time.

Performance Objective: To identify, test, sample, contain, extinguish, and/or abate the hazard utilizing the expertise and resources of the LF&EMS Hazmat Response Team, including any kind of specialized gear, tools, equipment or knowledge beyond the scope of a First Responder; evacuate civilians within the area of the fire department having jurisdiction as necessary.

Hazardous Materials Emergencies – Level III

Goal: An effective response force of fifteen personnel deployed via two engine companies (one of which shall be Engine 7), one rescue company, one medic unit, one battalion chief and the hazardous materials unit shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all hazardous materials – level II incidents. The full complement shall arrive within twelve minutes total reflex time.

Performance Objective: To identify, test, sample, contain, extinguish, and/or abate the hazard utilizing the expertise and resources of the LF&EMS Hazmat Response Team, including any kind of specialized gear, tools, equipment or knowledge beyond the scope of a First Responder; evacuate civilians within the area of the fire department having jurisdiction as necessary.

Technical Rescue Emergencies

Goal: An effective response force of at least twelve specially trained personnel deployed via the first-due engine company and medic unit, in addition to the technical rescue team, including Engine 1, Truck 1, Medic 1, Rescue 1, Battalion 1 and the technical rescue trailer.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all technical rescue emergencies within the City of Lynchburg. The full complement shall arrive within 20 minutes total reflex time for 90 percent of all incidents, also within the City.

Performance Objective: To recognize and identify the need for technical rescue services such as: structural collapse rescue, trench rescue, high/low angle rescue or confined space rescue. Perform rescue or incident stabilization as necessary to accomplish life safety and property conservation and to stop the escalation of the technical rescue incident where found. Typically this means conducting search and rescue for any victims, establishing a safe area of operations, plus limiting further damage than that which has already occurred. The first arriving unit is capable of starting rescue work toward mitigation to involve size-up, requesting additional technical rescue services, performing rescue, shoring, and initiating other steps toward incident stabilization until additional resources arrive.

Miscellaneous Calls for Service

Goal: An effective response force of three personnel deployed via one engine company shall respond.

Measure: The first unit shall arrive within nine minutes total reflex time, for 90 percent of all miscellaneous calls for service.

Performance Objective: To investigate the possible presence of potentially hazardous conditions that caused the notification of LF&EMS. If such conditions are present, the first arriving unit is capable of starting rescue work or advancing a first line for the fire control. Additional engine and truck companies may be summoned to provide additional personnel for tasks already started plus, ventilation, salvage, and other work as necessary.

Emergency Medical Services - Emergent

Goal: An effective response force of five personnel deployed via one engine company and one medic unit shall respond.

Measure: A basic life support unit shall arrive within six minutes total reflex time, for 90 percent of all emergent EMS calls for service. An advanced life support unit shall arrive within 10 minutes total reflex time for 90 percent of all requests.

Performance Objective: Stop the escalation of a medical emergency beyond the level of severity found upon arrival. Specifically, assess patients and prioritize care to minimize death and disability, intervene successfully in life-threatening emergencies, stabilize patients to prevent additional suffering, and provide basic or advanced life support, transporting as necessary.

Emergency Medical Services - Urgent

Goal: An effective response force of two personnel deployed via one medic unit shall respond.

Measure: The first unit shall arrive within six minutes total reflex time, for 90 percent of all urgent EMS calls for service. If it is anticipated that the

first due medic unit will have greater than 6 minutes total reflex time, then the first due engine company shall be dispatched with a measure to arrive within 6 minutes total reflex time, and the medic unit to arrive within 10 minutes total reflex time.

Performance Objective: Stop the escalation of a medical emergency beyond the level of severity found upon arrival. Specifically, assess patients and prioritize care to minimize death and disability, intervene successfully in life-threatening emergencies, stabilize patients to prevent additional suffering, and provide basic or advanced life support, transporting as necessary.

Emergency Medical Services – Public Assist

Goal: An effective response force of three personnel deployed via one engine company shall respond.

Measure: The first unit shall arrive within ten minutes total reflex time, for 90 percent of all public assistance EMS calls.

Performance Objective: Stop the escalation of a medical emergency beyond the level of severity found upon arrival. Specifically, assess patients and prioritize care to minimize death and disability, intervene successfully in life-threatening emergencies, stabilize patients to prevent additional suffering, and provide basic or advanced life support and requesting a transport unit, as necessary.

Emergency Medical Services – Transport Only

Goal: An effective response force of two personnel deployed via one medic unit shall respond.

Measure: The first unit shall arrive within twenty minutes total reflex time, for 90 percent of all requests for non-emergency transports. This measure will utilize “travel time” rather than total reflex time as transports are generally scheduled in advance.

Performance Objective: Stop the escalation of a medical condition beyond the level of severity found upon arrival. Specifically, assess patients and

prioritize care to minimize death and disability, intervene successfully in life-threatening emergencies, stabilize patients to prevent additional suffering, and provide basic or advanced life support, transporting as necessary.

Response Capabilities

Using Geographic Information Systems (GIS) technology, 94.7 percent of all roads within the response area are predicted to be reached by at least one engine company from current stations within a four (4) minute travel time objective for the first due company.³

The areas that are beyond the four (4)-minute engine company travel time objective include portions of Wiggington Road (including the Boxwood subdivision), Hawkins Mill Road, Enterprise Drive (including most of Wyndhurst), the area behind Target in the Wards Crossing Shopping Center (including Chesterfield Drive, Windsor Terrace, Melinda Drive, and Alta Lane), and the Tyreeanna area, from Rockwell Road and points east.

Using the same GIS capabilities, those same roads are predicted to be covered by an advanced life support (ALS) medic unit within four (4) minutes travel time 68.9 percent of the time. While more than 30 percent of the response area is outside of the 4-minute travel time objective for the medic units, EMS resources (often ALS) often arrive by an engine company within the four (4)-minute travel time objective, and the ALS medic unit will arrive within the eight (8) minute response objective.

Concentration is the ability to allocate enough resources on any specific risk to keep the event from becoming a major emergency. It refers to the spacing of multiple resources within close enough proximity to allow an initial effective response force to be assembled on scene within prescribed timeframes. An initial effective response force is one that has been deemed capable of stopping the escalation of a fire emergency, stabilizing a medical scene, affecting a rescue, and successfully handling an incident.

³ Lynchburg Fire Department: *Geographic Information System(GIS) Fire Suppression and Emergency Medical Service Response Capabilities Analysis*, International Association of Fire Fighters, November 16, 2004.

GIS mapping capabilities show that apparatus are predicted to reach 100 percent of the roads in the City of Lynchburg within eight (8) minutes travel time objective from all fire stations. Structure fires occurring at the farthest reaches of the eight (8)-minute travel time from fire stations are likely to burn up to and beyond the point of flashover, which does present significant risks to fire fighters operating within the structure. This is especially true in structures which have no automatic suppression or detection systems in place.⁴

According to the dispatch procedures for a full alarm assignment for a moderate risk fire (i.e., a residential structure fire), three engines, one truck, one rescue, one medic unit and one battalion chief are dispatched. LF&EMS is predicted to be able to respond to 90 percent of all city roads within eight (8) minutes with a full alarm assignment if all units are available.

Analysis of the concentration of units during 2002, 2003, and 2004 combined led to the following conclusions measured against the adopted standards, NFPA 1710 and OSHA standards for response to structure fires. Responses to the entire fire protection area were included, because OSHA standards apply to all structure fire response, and NFPA 1710 does not distinguish between different risk areas for this purpose. The below analysis includes the full complement total reflex time⁵ for structure fires.

- Alarm processing time at the 90th percentile⁶ is 1:27, which is over the one-minute alarm processing time standard by 27 seconds.
- Turnout time at the 90th percentile was 1:04, which is over the one-minute turnout time standard by 4 seconds.
- 1st engine travel time at the 90th percentile was 3:28, which is under the four-minute travel time standard by 32 seconds.
- 2nd engine is the usual method of meeting the OSHA Two-In/Two-Out rule. Travel time for the 2nd engine at the 90th percentile was 4:39.

⁴ *Lynchburg Fire Department: Geographic Information System (GIS) Fire Suppression and Emergency Medical Service Response Capabilities Analysis*, International Association of Fire Fighters, November 16, 2004.

⁵ Total Reflex Time (Customer Time): This measure is an indicator of the performance of the emergency service system, whether or not the fire department directly controls those elements. This interval adds the call processing interval to the response time interval. This is also referred to as the "customer time," because this is the total amount of time the customer is waiting for the emergency responders to arrive at the scene.

⁶ In a perfect world, 100 percent of the calls would be processed, turned out and traveled to within the adopted time goal. In the real world the call processing, turnout, and travel time is very good if the stated time goals are met at least 90 percent of the time.

- The department met the deployment standard of 15 firefighters on scene on all structure fires, and the travel time was 4:45 at 90th percentile, meeting the 8-minute standard travel time by 3:15.

The data shows that LF&EMS' current concentration of resources is meeting the NFPA 1710 standard and the OSHA Two-In/Two-Out Rule is also being met on structure fire responses. This is because the OSHA rule is based on the number of firefighters who must be on scene before an entry is made, independent of deployment-based response times.

Analysis of the concentration of resources during 2002, 2003, and 2004 led to the following conclusions for objective for response to EMS – Emergent calls for service.

- Alarm processing time at the 90th percentile is 1:09, which is over the one-minute alarm processing time objective by 9 seconds.
- Turnout time at the 90th percentile is 1:09, which is over the one-minute turnout time objective by 9 seconds.
- 1st engine travel time at the 90th percentile is 3:27, which is under the 4-minute travel time objective for basic life support providers to arrive on the scene by 33 seconds.
- Travel time at the 90th percentile for the medic units is 4:43, which is under the 8-minute travel time objective for advanced life support providers to arrive on the scene by 3:17 seconds.
- LF&EMS met the deployment objective for having a basic life support team on the scene within a 6-minute total reflex time by 15 seconds and an advanced life support team on the scene within a 10-minute total reflex time objective by 2:59.

Analysis of the concentration of resources during 2002, 2003, and 2004 led to the following conclusions for objective for response to hazardous materials calls for service.

- Alarm processing time at the 90th percentile is 1:32, which is over the one-minute alarm processing time objective by 32 seconds.
- Turnout time at the 90th percentile is 1:12, which is over the one-minute turnout time objective by 12 seconds.

- 1st engine travel time at the 90th percentile is 4:18, which is over the 4-minute travel time objective for basic life support providers to arrive on the scene by 18 seconds.
- The hazardous materials unit is usually dispatched either after the arrival of the first unit to confirm the presence of a hazardous materials scene or after the dispatcher receives additional information that upgrades the response. Nonetheless, the travel time for the hazardous materials unit at the 90th percentile is 7:09, which is under the 10:00 travel time objective by 2:51.
- LF&EMS met the deployment objective for having an effective response force on the scene of a hazardous materials emergency in 12-minute total reflex time is met with a total reflex time of 9:53 at the 90th percentile.

The safety of the public and firefighters must remain a priority when apportioning additional resources and planning for the future. With the ever-increasing challenges posed by rising costs and revenues that have not in recent years kept pace with the department's cost curve, fire managers are faced with constructing response plans that stretch response resources and personnel. The balance is to achieve efficiency while still meeting the safety standards such as the OSHA-mandated Two-In/Two-Out rule and NFPA 1710.

Analysis of the concentration of resources during 2002, 2003, and 2004 led to the following conclusions for objective for response to technical rescue calls for service.

- Alarm processing time at the 90th percentile is 2:00, which is over the one-minute alarm processing time objective by 1 minute.
- Turnout time at the 90th percentile is 0:57, which is under the one-minute turnout time objective by 3 seconds.
- 1st engine travel time at the 90th percentile is 4:58, which is over the 4-minute travel time objective by 58 seconds.
- The technical rescue unit is usually dispatched either after the arrival of the first unit to confirm the presence of a technical rescue scene or after the dispatcher receives additional information that upgrades the response. The travel time for the technical rescue unit at the 90th percentile is 15:33, which is over the 12-minute travel time objective by 3:33.

- LF&EMS does not meet the deployment objective for having an effective response force on the scene of a technical rescue emergency in 14-minute total reflex time with a total reflex time of 18:30 at the 90th percentile.

Evaluation of Response Reliability

Response reliability is the probability that the resources assigned to a territory will be available to respond from within that territory when an emergency occurs in that area. Response reliability would be 100 percent if every emergency response vehicle were available in its station when a fire or emergency call is received. In reality, there are times a call is received when the first-due unit is out of area or unavailable. This requires that a later-due unit, in the pre-determined response order, be assigned the response. If the later-due unit is too far away, the call cannot be handled within the desired total reflex time.

As the number of emergency calls per day, training demands, and other routine activities (such as taking apparatus to the repair shop) increase, so does the probability that the first-due company will be out of area or unavailable when a call is received (decreased reliability). There is not a current industry standard for response reliability, although departments should work to ensure that response reliability levels are adequate to meet established performance objectives.

Four of the eight engines fall below the average response reliability of 76.9 percent. Engines 1 and 6 have a lower than average response reliability for several reasons, but primarily because these are the engines that are placed out of service when staffing levels fall below minimums. Additionally, when Engine 6 is out of service it misses a greater number of calls than do other engines when they are out of service. However, the concentration of engine resources around Station 6 provides for coverage. Additionally, with Engine 6's high call volume, there is a greater possibility of multiple calls being received at concurrent times. Engines 3 and 8 also have low response reliabilities, which is evidence of the ever-increasing call volume as a result of development within Engine 3 and 8's service areas. With the higher call volume, there is the higher probability that Engine 3 and 8 will already be on another call.

The average response reliability for the four emergency medic units assigned to 24-hour shifts is 70.2 percent. Two medic units, Medic 3 and Medic 6 fall below the average. The actual response reliability percentage is inversely proportional to

the call volume for each of the medic units (i.e. Medic 6 has the highest call volume, but has the lowest response reliability). Medic 4 has the highest response reliability at 76.8 percent, followed by Medic 1 with 74 percent. Medic 3 has a response reliability of 69.4 percent and Medic 6's response reliability is 60.6 percent.

Future Needs, Recommendations and Service Improvement

Every quality organization must engage in continuous self-examination and must seize opportunities for improvement as they are identified. LF&EMS has identified several opportunities for improvement as a result of the CFAI accreditation process and the development of this SORC document, which include the following:

1. Use this document and the Lynchburg 2015 document to **continue a comprehensive environmental analysis** of the projected demands that will be placed on the organization by continued growth, greater density, shifting demographics, and other risks in the future.
2. Work with the City's policy makers to **ensure that Lynchburg maintains a fire fighting/emergency medical force adequately matched to the identified risks, hazards, and demands** of the community.
3. **Establish training programs for all personnel**, with an emphasis on company officers, to review, evaluate and discuss information tracking, use of communications/electronic equipment, computer program interface, and educate them about the link between data, response coverage and deployment decisions.
4. **Enhance the uses of the fire and EMS data reporting systems** to collect more detailed information on unit operational performance. For example, LF&EMS knows how many incidents a unit was dispatched on and arrived on the scene, but not how often the units performed a specific task – such as how often an aerial device actually deployed a master stream.
5. **Enhance and use the “Premise” module on the Visual Fire Info reporting system** to allow for the collection and analysis of more detailed information about buildings in the city. This analysis will serve as a basis for considering whether more closely defined *risk zones* or *demand zones* are necessary for operational planning, or if current *response zones* are effective. Additionally, provide occupancy information, such as

suppression systems, and other key risk elements as identified in the RHAVE⁷ program.

6. **Maintain the regular revision of the Facilities Plan** to help budget, prioritize capital needs, and forecast. There could also be an effort by the city to review each department's facility plan to determine if there are possible cross-functional purposes that new buildings could be utilized for – such as police sub-stations, recreational facilities, or outposts for other city services that are otherwise located in a single-location, like city hall.
7. **Incorporate recommendations highlighted in this document into the department's strategic plan** as goals, strategies or performance measures, where both financially and operationally feasible.
8. **Expand data analysis capabilities and project deployment needs** through computer applications and models.
9. **Address the issue of exception reporting** and facilitate developing a mechanism in the reporting software so companies can select from a pre-defined drop down list. This will enable the department to more accurately assess response time performance when companies face circumstances that cause a delay or cause a first-due unit to not be the first-due unit to arrive or be dispatched.
10. Establish a process to record *productivity reports* in order to **perform analysis and produce comprehensive reports on resource "true" availability and utilization** at the company level. With this, a measure of true "*out of service*" times will be readily available.
11. Research information on the various methods of delivering training programs to the companies to **reduce the amount of time that units are out of the first-due response zones for training.**
12. Perform improvements in **determining hazardous materials dispatch call types.**
13. **Implement a reporting mechanism/procedure for technical rescue stand-bys** conducted through the PIER⁸ program.
14. **Consider alternative training delivery options**, including the feasibility of a centralized emergency services training center, to limit the *out of*

⁷ LF&EMS utilizes a software program called Risk, Hazard And Value Evaluation (RHAVE) to provide an accurate and current description of the values-at-risk in the community. Values-at-risk (VAR) is the inventory of a community's potential fire problems arrayed from the most valuable and vulnerable risk to the least valuable and vulnerable risk that the fire protection agency is deployed to protect.

⁸ The technical rescue team has established a program called *Partners in Emergency Response* (PIER). The PIER program was formed to provide area business and industries with the continued availability of specialized emergency services. The partnership meets the Occupational Safety and Health Administration (OSHA) ruling that amended the 1910.46 Permit Required Confined Space regulation effective February 1, 1999.

service time or to limit the deviation from the established total reflex time response goals while conducting on-duty training.

15. **Conduct a careful review of response times, resources reliability, call volume, station resource levels and deployment levels** in determining alternatives for improving response times in targeted areas of LF&EMS' jurisdiction.
16. **Initiate measures to improve the interaction between LF&EMS and LynCom**, including additional fire and EMS dispatching training and monitoring of performance measures. **Efforts to reduce the call processing time within the adopted standard need to be initiated.**
17. **Work with surrounding jurisdictions to study the feasibility of automatic aid agreements or contract service areas** to prevent the duplication of services in *overlapping* station service areas.

When this document recommends changes to a LF&EMS standard, and as a part of the annual evaluation of LF&EMS' Standard of Response Coverage, specific information needs to be reconsidered for each of the recommended performance standards. Such information includes:

- National, state or local standards used to establish goals;
- Applicability of the desired performance standard to LF&EMS, considering its resources and the risk analysis;
- Estimated costs as a result of implementing new goals (for example, if additional staffing is required, the estimated costs of full time employees);
- The desired timeline for improvements or obtaining the performance standard; and
- The method to measure the stated goal and/or performance standard.

LF&EMS recognizes that NFPA 1710 has established a deployment standard with specific response times and staffing for all types of calls. We will continue to measure our performance against these response time goals as well as our own adopted response time goals. However, the level of staffing of fire and other emergency apparatus remains a local decision in order to allow jurisdictions appropriate flexibility to deal with their environment, as long as legal mandates and safety concerns are met. It is the responsibility of the authority having jurisdiction to assess the risk in the service community and to provide the needed resources to control that risk safely and effectively.

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